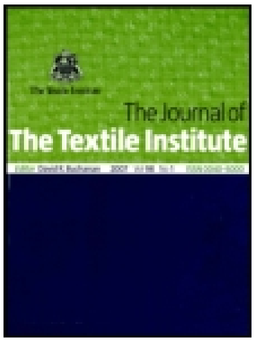

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Journal of the Textile Institute Proceedings and Abstracts

ISSN: 0368-4504 (Print) (Online) Journal homepage: http://www.tandfonline.com/loi/tjti19

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Thomas Barraclough

To cite this article: Thomas Barraclough (1911) BAST FIBRES WITH SPECIAL REFERENCE TO RAMIE, HEMP, JUTE AND FLAX: (Read by Mr. W. Bleakley, of Manchester.), Journal of the Textile Institute Proceedings and Abstracts, 2:2, 139-151, DOI: 10.1080/00405001108631716

To link to this article: http://dx.doi.org/10.1080/00405001108631716

Published online: 09 Nov 2010.

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BAST FIBRES WITH SPECIAL REFERENCE TO RAMIE, HEMP, JUTE AND FLAX.

By THOMAS BARRACLOUGH, Harrogate.

(Read by Mr. W. Bleakley, of Manchester.)

HAVING been requested by the Textile Institute to prepare a paper on Ramie, having regard to its present position and future prospects, to be read at a meeting in Belfast to the members of the Textile Institute, I have pleasure in complying with the former part of their request. I am sorry that the uncertain state of my health renders it impossible for me to go to Belfast or take any part in meetings, as I might have been able to answer questions and to supply further information had I been able to be present.

It will be observed that in the title of my paper I make special mention of "Bast Fibres," because in the course of my paper I lay stress on the Bast family relationship to each other of ramie, hemp, jute, and flax. There are many other varieties of Bast fibres, but my purpose will be served by referring to what may justly be termed the four leading members of the Bast family.

I have for many years taken a great interest in ramie, and my interest has grown from year to year, especially as I have had ample opportunities of becoming both technically and commercially acquainted with ramie in all its conditions, from the growing plant to the yarn and the woven textures.

I have attended numerous trials of machinery, both Government and private, for decorticating ramie. I have inspected important ramie spinning mills and have long taken great interest in and familiarised myself with the fitting up of ramie factories.

Ramie is entitled to be considered the "King of Fibres." Its tensile strength is almost equal to three times the strength of any known fibre. Assuming the strength of ramie to be 100, the strength of hemp is 36, of flax 25, of silk 13, of cotton 12.

Its fibre, emanating from well-grown, good quality stems, is of extraordinary length, say, up to 14 in., and capable of being spun into very fine yarns equal to, say, 120's cotton or 336's flax. The fibre is noted for its lustre, equal almost to that of silk; likewise for its softness and adaptability for spinning into yarns suitable for the manufacture of a great variety of textile goods. I may also add that ramie fibre has the peculiar quality of resisting damage from moisture and damp.

The position of ramie at the present day may be considered encouraging and hopeful. Its manufacture has made considerable progress during the last ten years, but it would be useless to disguise the fact that the progress made might have been much greater. The results of valuable and varied experience have been largely ignored and opportunities for progress have been lost. Difficulties have been magnified out of all proportion, and ramie—undoubtedly the fibre possessing the maximum of good qualities—has not yet attained the position to which it is entitled. I am, however, full of hope that the time is at hand when ramie will be looked upon, not only with sympathetic intelligence, but also with a firm practical determination on the part of spinners and manufacturers to make it a leading article of manufacture in Great Britain, Ireland, and in our Colonies.

Foreign countries, France and Germany especially, have surpassed us in their practical appreciation of this fibre and in the success resulting from their treatment of it.

The causes of our lack of success and of foreign success with ramie are explainable, but more good will result from my endeavour to enlist the interest and support of the members of the Institute in the future of this valuable fibre than by further reference to the past.

The fibre-bearing members of the Bast family possess a rich, gummy juice, and it is this juice in the ramie stems which has at all times been the cause of much difficulty, waste, and loss. A few remarks will serve to illustrate this from the practical point of view.

Immediately the fibre-bearing stems of these Bast plants are severed from the roots, the juice in the stems is liable to become the most deadly enemy of the fibre, because of its tendency to oxidise through contact with the atmosphere, to coagulate and form gum of a peculiarly tenacious and malicious character.

Before any of the Bast fibres, such as ramie, hemp, jute, flax, can be utilised industrially, steps have to be taken to render them gum-free, and this is done in various ways. In the case of ramie, for instance, many thousands of small farmers in China grow each a small quantity of ramie stems. After cutting the green stems, he scrapes them by hand labour, in order to remove the skin and the pith from the fibre. The production is very small; a man working a whole day is considered to have done well if he has produced 2 lbs. to 2½ lbs. of dry fibre. This ramie fibre is called "China grass," and in consequence of the very varying conditions of climate, soil, and labour, the quality and condition of the fibre is liable to be irregular, but such is the large annual production in China that ramie factories would have to close if it were not for this precariously obtained fibre.

It is well known that "China grass," as supplied to Europe and the United States, is far from being a clean fibre. It has to pass through a somewhat complicated degumming process at the mills, involving considerable skill and practical knowledge, in order to render it gum-free and in condition to pass through the machinery. During this process the fibre loses about 30 per cent of its weight, and this loss is represented by the juice-formed gum which the workmen in China have not been able to extract during the fibre decortication.

There are several descriptions of ramie decorticating machines, more or less successful, for carrying out the process. The stems are fed into them in their green state, and the action of the machine removes the outer skin or cuticle, the internal pith, also a small portion of the juice. Immediately after leaving the machines the fibre is dried, the juice it contains is transformed into gum by contact with the air and coagulation. Such fibre, however well decorticated, comes to Europe and the United States in somewhat similar condition as China grass; that is to say, the tenacious gum which it contains renders necessary the degumming process already mentioned, and the loss in weight reaches in some cases 50 per cent.

It is alleged against the majority of these machines that their capacity of production is very small compared with the commercial requirements. The labour involved is also stated to be excessive, and in some cases the mechanical action of the machine treats the fibre injuriously and causes undue waste. In a word, the commercial requirements of the ramie market have not been fulfilled by the productive capacity either in quality or quantity of these machines.

During the official Government tests of machines in France, which I attended and where I had the opportunity of seeing a great variety of ramie decorticating machines at work, I obtained valuable experience in connection with the requirements of efficient decortication of green ramie stems. I made the acquaintance of a number of inventors of decorticating machines, of members of the Commission, of delegates from other countries, and I willingly bear witness here to the enterprising and intelligent interest shown at all times by the French Government and French inventors and machine makers in the direction of proving and making known the wonderful qualities of ramie, and of encouraging the construction of machines for decorticating the fibre. I make special mention of my old friend, Mr. Faure, of Limoges, a machine maker, whose great interest in ramie led him not only to invent and improve ramie decorticating machines, but also to successfully grow ramie on his own property, so as to be able to study its peculiarities and to add to the general knowledge and appreciation of the fibre.

Reverting now to the mode of treating the freshly-cut stems or stalks of other Bast plants, such as hemp, jute, etc., in order to free the fibres from the cuticle, the pith, and the gum, the system generally employed is to dry them first in the open air. When thoroughly dry they are placed in retting pits, tanks, or water courses, with the object of denaturing all except the fibre by means of the retting process, the action of which is really putrefaction to a certain degree; the Americans justly call it "the putrifying process." The fibre in the stems escapes putrefaction, but does not altogether escape deterioration. It undergoes a dyeing process when in the pits, and after the stems are dried it is found in most cases that in addition to the colour imparted to the fibres, the quality of the fibre has suffered, as a result of the retting process, by the loss of a considerable percentage of its natural strength. In some cases also the fibre is found to have become brittle and harsh, in addition to which the mechanical after-treatment of the retted fibre, by the breaking and scutching machines, through which it has to pass before becoming completely free from extraneous matter and ready for spinning, has a tendency to increase the damage done by the retting process.

I have not much practical knowledge of flax, but as this paper is being read in Belfast, the home of the flax industry, and in the hearing of many practical flax manufacturers, I leave it to them to judge as to the accuracy of my remarks when applied to flax, in addition to hemp, jute, and other classes of Bast fibres.

During the long course of my practical connection with ramie and the ramie industry, I have always been of opinion that a fibre, possessing such wonderful natural qualities as ramie does, is worthy of a more intelligent treatment than either the degumming process or the retting process as carried on in so many countries under so many circumstances, as these are always detrimental to the fibre treated. I have thought that if a practical machine could be invented, capable of decorticating large quantities of ramie stems in their freshly-cut state, freeing the fibre from all extraneous matters, and simultaneously liquidising and washing away the juice, the ramie spinning and manufacturing trade would at once respond to the facilities provided for supplying the raw material in the exact condition and in any quantity desired by the market. Existing firms would increase their means of production, and many firms who have regarded ramie with sympathetic interest would commence its manufacture, seeing that the supply of raw material in the desired condition and in any quantity demanded would thus be assured. Such a machine would enable owners of plantations to cut their growing crops of stems systematically, to transport them in their fresh green state to the machine, and to obtain clean, gum-free, white, well-washed fibre, which, after drying, would be baled, sent to market, and sold to the buyers in the condition desired by the trade.

Much practical experience with various other decorticating machines used in connection with the production of Sisal, Bowstring hemp, Mauritius hemp, New Zealand flax (Phormium tenax), and a variety of other leaf fibres has greatly facilitated my efforts to invent a practical system of decorticating ramie stems and to produce large quantities of fibre, free from gum and retaining all its natural qualities. The leaf-decorticating machines have been improved by many inventors, and the value of these machines has grown enormously, their object being to treat a large quantity of leaves (say 125,000 per machine in 10 hours) to obtain the maximum percentage of good fibre from the leaves with the minimum of waste and of labour. One of the latest of these machines an English one, with which I am connected, contains several very important improvements, the principal one of which is an apparatus for effecting the simultaneous washing of the fibres during the decorticating process, and in my search after a good system of producing large quantities of first-class, gum-free, white ramie fibre, I decided that such a machine could be adapted to the decortication of Bast stems, such as ramie. The necessary modifications were accordingly carefully studied and applied, and the result has been a thorough success. The tests made in the East, where an ample supply of green ramie stems is available, have practically proved that a machine embodying the leaf-fibre decorticating process, but with the necessary mechanical additions and modifications in its construction, is capable of extracting from fresh green ramie stems not only the whole of the fibre they contain, but likewise during the decortication is able to liquidise the juice and wash it away instantaneously, so that the ramie fibre issues from the machine gum-free, in its natural colour, and retaining all its good qualities.

The deleterious nature of the juice of ramie stems was confirmed in a remarkable manner by a special experiment. During the trials in the East it was decided to run the machine for a short time without employing the washing apparatus, and to use it simply for decorticating. A tank of hot water was, however, provided for washing by hand the fibre after it left the machine, so as to remove, if possible, the juice-formed gum, which during the passage of the fibre through the machine had not been treated with water. The result of the experiment was striking, namely: Whilst the decorticating apparatus of the machine had extracted the fibre from the green ramie stems and freed it from skin, pith, etc., the juice, with which it was permeated, passed with it out of the machine and, although the fibre was washed by hand in a tank of hot water within five minutes of leaving the machine, the oxidisation and coagulation of the juice in the fibres had already taken place. It began immediately the fibre was exposed to the air, and the juice, coagulated in the form of gum, clung to the fibre during the hot water washing with such tenacity, that it was not possible to free the fibre from the gum, thus proving that unless ramie juice is washed away during the decorticating process it forms a gum, which can only be removed by undergoing the ordinary degumming process now in use in most ramie spinning mills.

This machine has two decorticating drums furnished with special strippers. The first drum decorticates one-half of the length of each stem, and the second drum decorticates the remaining half.

The stems pass into the machine in large quantities by means of special feed rollers, and parallel with the rollers, between which they undergo a crushing operation, essential for facilitating the subsequent decorticating process. These rollers (six feet long) are furnished with means for easily regulating the pressure that may be found requisite. The flattened stems then pass forward automatically between endless feed ropes, which firmly grip the stems about their middle and convey them to the first decorticating drum, which, by means of its high-speed strippers of special form, acting on the flattened stems during their passage over a curved bedplate, removes their skin, their non-fibrous parts, and their juice, thus producing the ramie fibre.

Each drum is furnished with a fibre-washing apparatus so arranged and applied that the current of water acts on the fibre during the decortication process in such an efficient manner that a small quantity of water has an immense continuous washing effect. Not only are the juices washed away, together with the bits of skin, pith, and non-fibrous parts, but simultaneously the action of the water, being applied to the extended parallel fibre under the action of the strippers, effects their complete cleansing, thus imparting to them their natural white colour. All the fibres receive an equal degree of treatment. There is likewise an entire absence of the entanglement so prevalent in fibres that have been washed by hand or by ordinary machines, and which is so damaging to their appearance and value.

The semi-decorticated stems, with their clean fibre hanging down, travel forward continuously from the first drum to an apparatus which automatically reverses the position of the stems, causing them to enter a second pair of endless ropes and travel forward to the second drum, by means of which the undecorticated halves of the stems are decorticated. This drum, its strippers, deadplate, and washing apparatus are similar to the first set. The second pair of feed ropes, passing on continuously, convey the clean fibre to the delivery bar, where it is received by a boy and handed to the men who convey it to the drying ground or drying apparatus.

This machine has other important features not hitherto found in fibre decorticating machines. The strippers of the decorticating drums can be set to the deadplates to the one-hundredth part of an inch with the greatest ease and accuracy, so as to be able to regulate the degree of decortication to the requirements of the stems under treatment and to retain it.

The amount of decortication received by the stems can also be varied by regulating the speed of the feed ropes in relation to the speed of the drums. Slower speed of the ropes gives more decortication; quicker speed of the ropes gives less decortication. This is a valuable feature considering the great variety of stems, which need special and varying treatment in order to extract the largest quantity and best quality of ramie fibre from each class of stem with the least waste. All the bearings of the machine are fibre-proof, and their lubrication is automatic.

All the motions of the machines are automatic, so that the amount of attendant labour required is very small. One labourer opens the bundles of ramie stems and hands them to two other labourers, who feed them into the machine. A boy is required at the delivery end of the machine, as already stated.

The percentage of clean, dry, gumless ramie obtainable from these stems by the machine, after allowing for a wastage of about

5 per cent of fibre during the decorticating process, will vary according to the quality of the stems, but may be taken at 4 per cent; thus 40 tons of green stems will produce about 3,600 lbs. of gumless ramie when dry.

Some classes of stems may with great advantage undergo a preliminary short soaking before being fed into the decorticating machine. That is to say, the machine will treat not only fresh green ramie stems, but also stems the skins of which are no longer quite fresh, but in which the juices have not coagulated. Such stems can, immediately after soaking, be fed into the machine.

The passage of soaked stems through the machine does not delay or interfere with the decorticating process; on the contrary, the decortication may be facilitated by the previous soaking for a few minutes.

The labour involved in soaking such stems is trivial compared with the benefit obtained by being able to obtain the fibre from stems which would otherwise have been waste. The condition of the stems and their adaptability for treatment by the machine after soaking is subject to the skilled opinion of the foreman, who can easily judge, by actual experiment with a few stems, of their adaptability.

By means of this machine ramie growers will now be in a position to increase their plantations and to enter freely into the cultivation of ramie and production of ramie fibre suitable for the market, and for which there is such a large demand. Each machine will enable them to transform in ten hours about 120,000 green ramie stems, according to size and quality, into marketable ramie fibre, the quality of which is easily ascertainable on inspection by ramie buyers. Encouragement will thus be given for increasing the existing spinning mills; as there will be no fear of shortness of supply for the buyer, and no fear of absence of customers for the growers.

I may here remark that, although advocating so forcibly the abolition of the degumming process by rendering it unnecessary, I do not wish my hearers to obtain the impression that no progress has been made of late years in the art and processes of degumming ramie fibre. On the contrary, a few of the leading ramie spinners carry on the degumming of China grass and ramie ribbons with considerable success. The degumming process, as its name indicates, has for object the removing of all the gum and extraneous matter from the actual fibre. To effect this special care has to be taken not to injure or waste the fibre, its strength, its lustre, its softness and suppleness, its natural colour, and not to render it in the slightest degree brittle.

The process, when properly carried out, ought to leave the fibre after lubrication capable of passing freely through all the various machines and of being spun into all classes of yarns even up to the finest. A considerable portion of degummed fibre is deteriorated by imperfect degumming and ignorant treatment, and one or more of the above specified injuries are the result.

At the present time not only is modern degumming plant available for new installations, but also the knowledge of the most improved degumming process. It is not likely that the degumming process will be abolished for many years to come, because the whole of the present available supply of raw fibre contains gum, and this supply will be to a large extent available, even when the new ramie decorticator producing gum-free fibre has been set to work on many ramie plantations. China exports upwards of 20,000 tons of China grass (ramie) yearly, all grown and extracted by native labour, and it is not likely that this trade will decrease, as the Chinese stick so tenaciously to all their old trade customs. Other supplies of ungummed ramie fibre and ramie ribbons from small cultivators are also available.

Having dwelt somewhat at length on this matter, which I am inclined to believe will be viewed with sympathetic interest, I am led to touch on another question of great importance to the ramie spinner, and which I am afraid is only partially known to the generality of ramie spinners.

All Bast fibres, such as ramie, Russian, Italian, and other hemps, jute, and their substitutes, are much improved by lubrication before passing into the machinery. The great success of the efficient lubrication of ramie has amply proved the soundness of the principle. The choice of a lubricant is a very important matter; it is a mixture mainly of oleaginous materials, as no single element is capable of forming a practical ramie lubricant.

The method of imparting the lubricant to the fibre may vary, but a very practical one is to take the ramie filasse in a perfectly dry condition and to soak it for about 20 minutes in a bath of the hot lubricant, after which it is treated in a hydro-extractor for the removal of superfluous lubricant, and is afterwards dried in suitable drying closets without great heat. It is then allowed to remain in store with a view of maturing the fibre, to the beneficial effects of which it is very susceptible.

When removed from the dry store the filasse is first passed through the softening machine (placed in a perfectly dry room, and working under dry conditions). The softened filasse is then suspended for a short time over a water tray in order to absorb naturally the degree of moisture it requires during its passage through the machinery. Experience shows that the thus lubricated filasse travels easily and freely through the various machines, and the drafts are greatly facilitated. In its passage it keeps the parts with which it comes in contact efficiently lubricated, but to such a slight degree as to be scarcely apparent.

The benefits of this system of lubrication are manifold and of great importance. A superior quality of yarn is produced, because the whole process has tended to preserve the full strength of the fibre, its beautiful lustre, its softness, and its freedom from brittleness. There is also a great reduction in the amount of waste. In some ramie mills I have known the waste from spreader to twisting frame has amounted to 8½ per cent, and I have heard of others being 10 per cent, but with properly treated and suitably lubricated fibre and good management the waste ought not to exceed 6 per cent from spreader to twisting frame in a well-equipped mill (exclusive of noils). This has been confirmed to me by the managers of two of the highest class ramie mills.

Having now finished that portion of my paper relating to ramie, hemp, and jute, I should like to add a few remarks respecting that other important Bast fibre, namely, flax, and its treatment prior to its entrance into the factory.

These remarks will, I hope, prove interesting, notwithstanding that what I say in Belfast respecting flax must be of a suggestive character. I have frequently asked myself recently, why do the flax growers in all countries continue to use the old retting methods (water and dew) in this twentieth century? Can no better system be devised? Flax retting certainly has antiquity to justify it, if such were of any practical and appreciable value.

We have historical proof that the Egyptians even 5,000 years ago employed the retting system for their flax. They were remarkably clever in all that they did considering the absence of what we call practical appliances. The results they obtained, the excellent quality and beauty of their fabrics, are even now entitled to be designated marvellous, but if they had lived in the 20th century, surrounded by inventive machine makers, would they have clung so tenaciously as they did to the retting process? I cannot answer that question, but I ask myself, is there really anything in the retting system which improves the flax fibre or its colour, which adds to its strength, its softness, its ductility, or its freedom from brittleness?

Standard books of reference are unanimous in answering the question with an emphatic negative.

I need not set forth here a detailed list of the deteriorating effects and difficulties of the retting process, its loss of time, the great expense of the labour and processes involved, including breaking and scutching.

Friends connected with the linen trade tell me that the trade would increase and improve in many directions if flax spinners were able to freely buy their flax fibre perfectly clean and with all its natural qualities unaffected by the process of extraction it had undergone. Why not therefore try and abolish the retting system with all its disadvantages by substituting a common-sense practical system of instantaneous mechanical decortication and washing, based on practical results obtained with other Bast fibres, such as ramie? I believe it is quite worth trying. I may even go so far as to say that I think a great mistake will be made if the new system is not tested as early as possible by decorticating flax in the green state immediately it has arrived at the stage which the grower knows is ripe for pulling. I am told that after that period the fibre does not increase in value.

A flax decorticating machine, specially constructed on the Bast system, could be easily placed at or near an important flax growing estate and set to work under favourable circumstances, so as to prove, by practical results, the value of the principle of immediate decortication of the fresh-pulled flax, combined with the simultaneous washing away of the juice and the production of really high-class fibre. Such a machine ought to give the following results:—

A.—A much larger percentage than is usually obtainable of clean fibre, free from extraneous matters, thoroughly well washed, and in its natural colour.

B.—A much better quality of fibre, because there is nothing about the decorticating and washing action of the machine that can cause any deterioration of the natural qualities of the fibre. The treatment in the machine is very gentle, does not last a minute, and during the decortication the water applied in a special manner supplements the decortication by acting as a cushion to the fibre and by removing the juice and all extraneous matters.

C.—A very small percentage of waste compared with the retting system.

D.—The cost of transforming the freshly-pulled flax into clean fibre ought to compare favourably with the cost of the retting system and its attendant operations.

I believe there is great need for such a machine, and that its successful working will completely revolutionise in all flax producing countries the present system of treating the flax and the fibre.

DISCUSSION.

MR. LESTER (Manchester), opening the discussion, expressed regret that Mr. Barraclough had not gone more carefully into facts and figures, particularly with regard to the strength of fibres and of ramie in particular. He (Mr. Lester) declared that the figures indicating the relative strength of silk and cotton as 13 and 12 were wrong upon any basis he could imagine, and certainly they were if individual fibres or yarns of the same count were taken as the common base. Ramie could in no sense be considered the King of Fibres. It showed a high tensile strength, but for all practical purposes it was far too brittle; indeed, it was one of the most brittle fibres he knew in relation to its tensile strength. It snapped easily under sudden strains, and this constituted the most serious bar to its commercial success. He wished he could see as much in its future as Mr. Barraclough inferred. Referring to Mr. Barraclough's recommendation to apply the degumming and decorticating process to flax, the speaker thought that the presence in ramie of many insoluble substances had been overlooked, and it was because they could only be made soluble by means of alkaline solutions or by the process of retting that simple mechanical treatment with water could never be a success.

MR. HORNER (Belfast) said: We have been speaking this morning about the lengths of ultimate fibres in flax, hemp, and jute;

the lengths of these fibres are equal in each. Is it not a fact that in ramie these lengths vary from 50 to 200 mm., offering, as any spinner here will know, a great impediment to the spinning of this material into fine counts? We find it impossible to spin China grass on flax machinery to a yarn equal to the fineness of the material. Some years ago I had experience in hackling ramie in a decorticated state. I found it split up into exceedingly fine fibres, but there was always a "nit" attached to it, owing to which no fine numbers could be spun from it. The great difficulty seems to be in drawing a fibre whose elementary lengths are so variable. I am sorry that the writer has not dealt more fully with the actual spinning process.

MR. BLEAKLEY said: Mr. Barraclough does not propose to use flax-spinning machinery, but, I think, some combination of worsted and flax machinery.

MR. QUILTER (Leicester) said: We find that Mr. Barraclough says the ramie fibre is noted for its lustre. We notice this lustre in the first stages of using it, but find that it has disappeared in the finished article. I should like to know how that is. If the lustre does not remain in the finished product it is of no commercial value.

MR. HALL-THOMPSON (Belfast) remarked: We endeavoured a few years ago to use ramie in ordinary flax-spinning machinery. The ramie had been hackled, but had not been prepared in the "rove," so that we found it was impossible to use it in the flax-spinning machines. Afterwards we got some into roving and tried to twist it into thread, but with regard to what the writer of the paper says of strength of ramie in comparison with other fibres, we found that when ramie was wet we could not get it to draw over the machinery, and we found it was impossible to spin it into anything except very coarse counts; and when dried again we found it was quite weak. We were unable to sell it to people who had been accustomed to use hemp. The writer of the paper says that flax does not improve by keeping, but my experience has been that by steeping it it can be kept and increased in value.

MR. GARRETT CAMPBELL (President Flax Spinners' Association) observed: What has struck me about this paper is the extraordinary effect that ramie has on those people who come in contact with it; it seems to drive away all sense of proportion and modesty. There must be some emanation from it that upsets their mental calculations. These people have been going amongst Belfast manufacturers for years, making the most remarkable claims on behalf of the fibre. Up to the present they have failed to substantiate their claims, but they still continue to advance them. I quite agree with what Mr. Lester has said regarding the strength or weakness of ramie. My experience is that ramie is notable for one particular quality, and that is its resistance to damp. It does not seem to rot in the same way as other bast fibres, and the result is that it has proved a success for coarse shoe threads and things of that kind which are constantly being subject to wet and being dried again. In that respect it has proved itself superior to any other fibre, but it is all nonsense to speak of it as the finest fibre in the world. In most of the qualities claimed for it not only is it not superior, but it is highly deficient, and the lustre which it possesses in the unspun state is largely lost when it is spun. In addition to that, it is not a lustre which appeals to the artistic sense. It is very harsh and cold, and is not comparable to the soft, ivory-like lustre of the best quality of flax. Mr. Barraclough asks why flax spinners continue to adhere to the old system of retting which has been in operation for thousands of years, and my reply is because it is the right system, and has survived every other.

MR. CARTER (Belfast) said: I have seen ramie spun in the largest ramie mill in the world. Mr. Horner, however, speaks of "nits"; these are due to the fact that the fibre has not been properly degummed. Regarding the ultimate length of fibre, it is true that it is longer than flax and hemp, but its ultimate fibres are supposed to be of approximate equal length, and probably the short fibres found by Mr. Horner were due to breakages in hackling. Ramie can be made into a roving like flax, and in consequence of its ultimate fibres being longer than flax, it must be spun over a longer reach. Ramie had been made into shoe threads, but its objection there is its hairiness; it is very hairy, and in some cases has to be gassed like cotton. I have, however, never heard of flax improving by keeping, except in what we call "coming to."

MR. ERSKINE (Belfast), being asked to speak, said: I have just returned from the United States and Canada. I spent a considerable time in the flax districts of Canada, where I found decorticating being done by imperfect machinery. I was astonished at the quality and quantity of flax being grown in Canada, but the retting process is not satisfactory, whilst the material is too heavy to send in its natural state. I was astonised at the army of people in all quarters who have patent processes. At Duluth, in company with a flax grower, I discovered a man who had been making a flax puller, but he had only partly developed it, and I helped him to get patterns. Afterwards I found a Presbyterian minister working with a flax puller most successfully. I might add that decorticating machinery is receiving considerable attention in Canada.

MR. BARRACLOUGH, who was unable to be present at Belfast, makes the following observations on the discussion which took place on his paper:—

He had read the reports of the discussion with amazement and was amused to think that such imputations against Ramie could be made in Belfast. He did not doubt the good faith of the speakers, but was bound to say that facts were against them. He had never heard complaints of brittleness, weakness, or lack of lustre against properly degummed fibre. The existence of so many ramie spinning and weaving establishments here and abroad emphatically contradicted the statements made.

He proceeded to mention a large number of articles manufactured from ramie, where strength, toughness, and lustre were essential, and where success had followed their production. Mr. Warburton, of the Ramie Company, Bredbury, was quoted as declaring against the alleged brittleness of ramie after spinning it for 16 years. This authority had had tests made upon 9in. by 4in. test pieces of cloth weighing 11 ounces per yard, and showing 846 lbs. in the warp and $840^{5}/_{6}$ lbs. in the weft, and it was questioned whether linen of equal weight and at a commercial price could show equal results. He believed that his critics had experimented upon badly degummed fibre partly denatured by the ignorant use of acids in the process. Much harm had been done by the circulation of samples produced by "cheap and quick acid processes," but the modern process effects no such injury, and accounts for the ever-increasing prosperity of the trade. He would not reply to personal remarks beyond advising that tests should be made upon fibre of known quality. What could be done abroad could also be done in Belfast, for climates did not affect fibres. The figures he had given in his article emanated from scientists of the highest rank, and they had used ramie untouched by acids. Special machinery was necessary for spinning ramie, just as worsted could not be spun upon woollen machinery. It was hoped that his paper, together with this refutation of complaints against ramie, might awaken growing interest worthy of Belfast.